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Frequency dependence of fast mode ultrasound attenuation of liquid 4He in aerogel

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Abstract

In our previous work, anomalous sound attenuation in superfluid phase was observed in liquid 4He filled in 97.0 % porous aerogel using longitudinal ultrasound at the frequency of 10 MHz. To understand the nature of the observed anomaly one needs to know the viscous coupling between normal component and aerogel strands. As far as the viscous penetration depth depends on frequency in the present work we have measured longitudinal ultrasound propagation in liquid 4He filled in 97.0 % porous aerogel at the frequencies 6, 10, and 15 MHz. In the normal phase the sound velocity had no frequency dependence and was reduced from that of bulk liquid, since the sound velocity in aerogel is smaller than in bulk liquid helium. The attenuation in normal phase is discussed using a viscoelastic theory. The obtained results indicated that the ultrasound experiment in normal phase was performed in low frequency or crossover regime. © 2009 IOP Publishing Ltd.

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